4 AIR QUALITY MODELING IMPACT ANALYSIS

This section describes the air quality modeling analysis that was conducted, including the models which were employed, the model input options and methodology used, and the supporting data. The purpose of the air quality impact analysis is to assess the Project's maximum predicted ground level pollutant concentrations against the applicable State and Federal ambient air quality standards (NAAQS), significant impact levels (SILs), and PSD Increments. A listing of the applicable SILs, PSD Increments, and the NAAQS is provided in Table 4-1.

Table 4-1: EPA Significant Impact Levels, PSD Increments, and NAAQS ($\mu g/m^3$)

Pollutant	Averaging Time	SILs	PSD Increments	NAAQS
SO_2	3-Hour	25	512	1300
	24-Hour	5	91	365
	Annual	1	20	80
PM-10	24-Hour	5	30	150
	Annual	1	17	50
NO_2	Annual	1	25	100
CO	1-Hour	2000	NA	40000
	8-Hour	500	NA	10000

The project is exempt from New Hampshire's hazardous air pollutant regulations (Regulated Toxic Air Pollutants, Env-A 1400) since the turbine will be fired with natural gas (exemption Env-A 1402.01(b)(4)(b)).

Since the project is a minor (non-PSD) emission source, no PSD Class I area modeling was be conducted. However, the Project will evaluate the PSD Class II Increments per the request of the NHDES.

4.1 Model Selection

In accordance with NHDES guidance, the refined modeling was conducted using the EPA AERMOD modeling system (dated 07026). The analysis was conducted in accordance with the *Air Quality Modeling Protocol* submitted for the project (see Appendix E), including comments made by the NHDES on the Protocol. The methodologies used are consistent with AERMOD and AERMET users guides, EPA's *Guideline on Air Quality Models (revised) (40 CFR 51 Appendix W)*, and NHDES's *Guidance and Procedure for Performing Air Quality Impact Modeling in New Hampshire*. The AERMOD model system was used to evaluate potential impact concentrations from Project emission sources at receptor locations representative of all terrain (simple, intermediate, and complex) surrounding the facility.

4.2 Land Use

A land use determination was made following the classification technique suggested by Auer (Auer 1978). The classification determination was conducted by assessing land use categories within a 3-km radius of the proposed site. Visual inspection of USGS topographic maps and aerial photos indicates that the majority of land use is characterized as rural. Therefore, rural dispersion coefficients were used for the air quality modeling.

4.3 Building Dimension and GEP Stack Height Analysis

A Good Engineering Practice (GEP) Analysis was performed in accordance with DES guidelines. The controlling building structure at the facility is the main turbine building, which is 37 feet above grade. Since this is a squat building, the calculated GEP height for the turbine stack is equal to 2.5 times the structure height. Thus, the calculated GEP height is 92.5 feet (2.5 x 37 feet). The proposed turbine stack height (55 feet) is less than GEP height. Therefore, EPA's Building Profile Input Program (BPIP-Prime) was used to define the height and projected width building dimensions of the "controlling" structures (as a function of flow vector) for the non-GEP stack. The BPIP-Prime results were used in conjunction with the AERMOD dispersion model to evaluate the wind direction specific building downwash effects for each stack. BPIP-Prime input and output data, along with a schematic diagram describing the facility buildings and stack, is provided in Appendix E.

4.4 Meteorological Data

The AERMOD modeling system contains a meteorological data processing program called AERMET which combines surface and upper air weather observations with surface characteristics based on land use to develop local dispersion parameters. In order to simplify the AERMET analysis, NHDES provides ready-to-use, preprocessed meteorological data files (in the form of .SFC and .PFL files) which are available on the NHDES web site. The files incorporate land use data centered on the meteorological monitoring sites (i.e., airport weather towers), so surface characteristic data processing by the applicant using AERMET is not necessary. Hillsborough County falls in the section of NH where NHDES recommends the use of meteorological data collected at the Concord, NH surface station. This surface data, which has been processed along with Gray, Maine upper air data for the years 2000-2004, was used in the modeling analysis.

4.5 Receptors

Discrete receptors were placed at 20 meter intervals along the compressor station fence line. In addition, a nested Cartesian grid is extended out from the fence line at the following receptor intervals and distances:

- At 20 meter intervals from the fence line out to 100 meters;
- At 50 meter intervals from 100 to 500 meters;
- At 100 meter intervals from the 500 to 1000 meters;
- At 200 meter intervals from 1,000 to 2,000 meters;
- At 500 meter intervals from 2,000 to 5,000 meters;
- At 1,000 meter intervals from 5,000 to 10,000 meters; and
- At 2,000 meter intervals from 10,000 to 20,000 meters.

Terrain elevations at receptors were obtained using BEE-Line Software's BEEST program and USGS digital terrain data. BEEST implements the AERMAP model which includes processing routines that extract USGS Digital Elevation Model (DEM) data (the four nearest points surrounding receptor) to determine receptor terrain elevations (by interpolation) for air quality model input. On-site survey data was also reviewed to ensure elevations were accurately determined around the site.

4.6 Emission Source Parameters

The emission source that will be considered with dispersion modeling is the Solar turbine. Per NHDES guidance, the small heating boilers (less than 10 MMBtu/hr combined) and the emergency generator were not be evaluated in the modeling analysis.

Table 4-2 summarizes stack and exhaust characteristics for the compressor station turbine. Table 4-3 provides criteria pollutant emission rates and stack parameters for the full range of normal operating loads (100%, 75%, and 50%) for the turbine under average ambient temperature conditions (conservatively assumed to be 40°F) and these conditions were used for annual average concentrations. Ambient temperature conditions corresponding to cold weather/higher emissions (0°F) were used for short-term concentrations. Emission calculations are provided in Appendix B.

Table 4-2: Stack Characteristics for the Solar Turbine

Parameter	Solar Turbine
Base Elevation, msl (feet/meters)	193 / 58.83
Stack Height (feet/meters)	55 / 16.76
Inside Stack Diameter (feet/meters)	6 / 1.83
Number of Stacks	1
Predominant Land Use Type	Rural
Stack Location: UTM-E (m) UTM-N (m) Coordinates relative to NAD 27	 307131 4739290
Controlling Building Dimensions (m)	17.68 (L) x 16.61 (W) x 11.28 (H)

Table 4-3: Emissions and Stack Parameters for the Solar Turbine						
Operating Load, %	**100**	**100**	**75**	**75**	**50**	**50**
Ambient Temperature, °F	**0°F**	**40°F**	**0°F**	**40°F**	**0°F**	**40°F**
Stack Exhaust Velocity, m/s	16.34	15.92	15.22	14.34	13.74	12.97
Stack Exhaust Temperature, °K	737	769	725	747	718	749
NO_x, g/s	0.70	0.67	0.61	0.56	0.51	0.47
SO_2, g/s	0.03	0.02	0.02	0.02	0.02	0.02
PM, g/s	0.05	0.05	0.04	0.04	0.04	0.03
CO, g/s	0.86	0.82	0.74	0.69	0.62	0.57

4.7 AERMOD Modeling Results

The maximum AERMOD predicted impact concentrations for the Solar turbine are provided in Table 4-4. Model results are compared to significant impact levels (SILs) for each pollutant. Maximum predicted AERMOD concentrations are less than the corresponding SILs for all pollutants and averaging periods. Since maximum predicted AERMOD concentrations are less than SILs for all pollutants and averaging periods, therefore, compliance with both the National Ambient Air Quality Standards (NAAQS) and the PSD Increments is demonstrated, and the project is approvable from an air quality impact standpoint. A detailed modeling summary for all modeled load conditions is provided in Appendix E. AERMOD input and output files in electronic format will be provided to the NHDES modeling staff (James Black) via email.

Table 4-4: Maximum AERMOD Predicted Concentrations for the Turbine Compared to SILs			
Pollutant	**Averaging Period**	**Maximum Concentration ($\mu g/m^3$)**	**SIL ($\mu g/m^3$)**
NO_2	Annual	0.63	1
PM10	24-Hour Annual	0.34 0.05	5 1
SO_2	3-Hour 24-Hour Annual	0.44 0.20 0.03	25 5 1
CO	1-Hour 8-Hour	14.84 7.478	2000 500